

ABSTRACT

A device having a positive electrode, a negative electrode, and an ion-conducting electrolyte in contact with both electrodes. Each electrode has a metal, a metal oxide, a hydrous metal oxide, alloy thereof, or mixture thereof, however, the electrodes are different such materials. The positive electrode is capable of storing and donating ions and electrons and reducing oxygen. The negative electrode is capable of storing and donating ions and electrons and oxidizing hydrogen. The electrolyte permits transport of oxygen and hydrogen. The device can charge using ambient hydrogen and oxygen. It can be discharged as an electrochemical capacitor or be operated in a fuel cell mode.